Muon Tracking System at KamLAND

L.A. Winslow[1] for the KamLAND Collaboration
[1]*Nuclear Science Division, Lawrence Berkeley National Laboratory, Berkeley, California 94720*

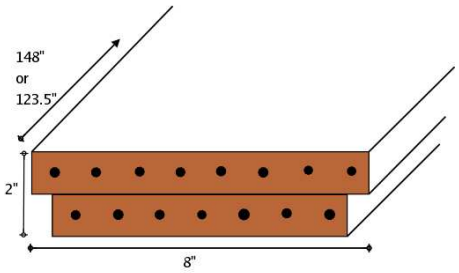

FIG. 1: Diagram of a Module.

KamLAND detects anti-neutrinos from nuclear reactors by looking for the delayed coincidence signal from the interaction of an anti-neutrino with a proton. This interaction creates a prompt positron annihilation signal followed by a neutron capture signal $200\mu S$ later. The largest background to this signal is neutrons produced by muon spallation which can create accidental delayed coincidence pairs. There are also light elements produced by muon spallation whose decay can mimic an anti-neutrino delayed coincidence signal most important of these being ^{9}Li and ^{8}He. Once these events are removed from the dataset, they are used along with ^{12}B and ^{12}N to check KamLAND's energy reconstruction. However, before spallation products can be removed from the dataset and utilized for other studies the parent muon must be detected and reconstructed.

KamLAND's geometry is perfect for reconstructing point like events. Muons are more difficult to reconstruct since they deposit light along a path through the detector and they produce at least an order of magnitude more light. Since reconstructing muons is so important to removing backgrounds and understanding the data, construction of a separate system to track a subset of muons entering KamLAND has begun. This external muon tracker is composed of scintillator paddles for triggering and proportional tubes for position reconstruction. These components were built for a fixed target experiment and are being refurbished for the muon tracker.

There are 53 proportional tube modules. Each module contains fifteen 1" x 1" x 123" or 148" tubes arranged in 1 layer of 8 above 1 layer of 7 which creates a 1/2" space between wires, figure 1. The modules will be arranged into two 3m x 3m squares each containing two layers of modules perpendicular to each other. This arrangement was chosen to maximize the muon flux through the detector. The bottom plane will have the ability to slide relative to the top plane and in this way different zenith angle distributions will be probed.

The system is almost complete. We repaired 32 modules and re-wrapped and tested the scintillator paddles. New front-end electronics boards were fabricated and tested with CAMAC logic units interfaced with the MIDAS DAQ software. A frame was designed to support the system and is ready to be assembled. Due to other work taking place on the deck of KamLAND the installation date has been moved to Fall of 2005.

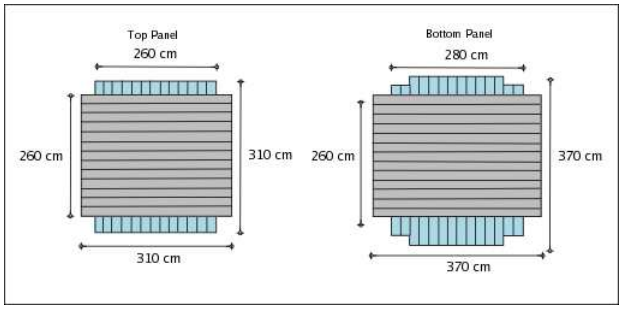

FIG. 2: Diagram of Two Panel Arrangement (panels will be placed on top of each other separated by 2m).